

Section 14

Delay Manager

The *Delay Manager* is a tool that enables monitoring and managing ground delay programs, by means of viewing a continually updated picture of the arrival situation at an airport. *Delay Manager* can be used to set up different models for managing arrivals at the airport and see the effects of decisions before implementing them. *Delay Manager* enables the Traffic Management Specialist to perform the following:

- **Monitoring an Estimated Departure Clearance Time (EDCT) Program.** *Delay Manager* allows a specialist to monitor whether the number of predicted arrivals at a controlled airport is running above or below the desired arrival capacity a specialist is trying to achieve. *Delay Manager* provides a chart, automatically updated every five minutes, of predicted arrivals in 15-minute time intervals. A specialist can then compare the predicted arrivals from *Delay Manager* with the capacity value from the ETMS or with an Airport Acceptance Rate (AAR) that is manually entered (for example, the same rate used in a Selective Controlled Departure Time program).
- **Modifying an EDCT Program.** If an EDCT program is not producing satisfactory results or if an airport's arrival rate changes, *Delay Manager* lets a specialist experiment with different ways of releasing flights from the program to resolve the problem. The specialist tells it what flights to release (by departure airport, center, or tier) and when to release them, and *Delay Manager* simulates the result on the bar chart.
- **Managing a Ground Stop.** If a specialist wants to put in a ground stop or already has one in that needs to be removed, *Delay Manager* helps to figure out the best way to manage it. Tell it what flights to stop, what flights to release, and when to stop or release, and *Delay Manager* simulates the result.

Delay Manager operates in its own window so that it can be used with the *ASD* or other traffic management tools. The Traffic Management Specialist can make requests through an easy to use *point-and-click* interface and see the results within a few seconds of the request. This allows the specialist to experiment with several different models in order to find the best solution for a situation.

Delay Manager communicates with various other ETMS processes as depicted in Figure 14-1. *Delay Manager* displays arrivals to an airport by means of a bar chart. Display Manager allows specialists to simulate holding delays on certain aircraft in order to determine their effect before issuing real-time delays. (It is planned for future releases that delays, once simulated, will be used to automate issuing SCDT control programs.)

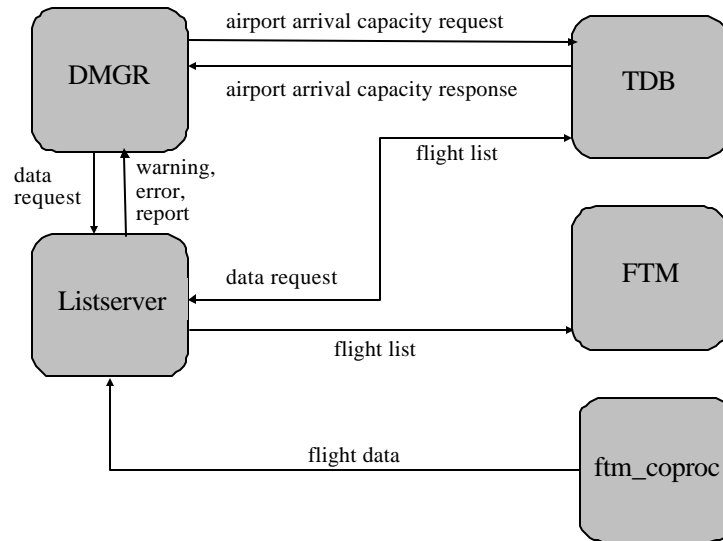


Figure 14-1: Delay Manager Role in ETMS

Design Issue

The motivation for the *Delay Manager* tool is to support the administration of ground stop programs. When considering putting a ground stop in, the specialist must be able to evaluate the effect it will have. The Monitor/Alert bar chart has allowed *some* evaluation by showing the predicted arrivals that are airborne and on the ground. However, this is only useful for a national ground stop; a groundstop for certain centers could not be easily evaluated. Also, the Monitor Alert bar chart obscures the ASD flights display and shows departures which use up space that could be used to show more arrivals.

Once a ground stop is in effect, the specialist can use the *Delay Manager* to see the effects of releasing a ground stop in a more controlled manner, by indicating which centers might be released and visually seeing that effect.

Execution Control

Delay Manager can run in several ways. It can be run in a stand-alone mode where a specific LSTNET output file feeds it data, and it does not connect up to Network Addressing. It is more often run by invoking the command: `/etms5/com/start_dmgr` BOS in an Aegis shell. The command center also has it defined in Tool Manager (TMGR) such that a certain airport's delays are automatically displayed on startup.

Input

Delay Manager accepts inputs from ETMS processes in the form of program arguments, configuration, parameter and data files, requests for statistics, flight data updates and airport arrival capacities, as well as user GUI inputs.

Program arguments are:

- Name of program executable, `/etms5/dmgr/dmgr`
- Start time for *DMGR* program. This is calculated automatically for the specialist if the `/etms5/com/start_dmgr` script is used.
- Airport the specialist wants depicted by the *Delay Manager* Program. Alternatively, the word *tutorial* can be used to run in stand-alone, tutorial mode.
- Test file name to use as data for bar charts/report. This argument only applies when running in tutorial mode.
- Test capacity. This argument applies only when running in tutorial mode.

Program parameter files and a brief description:

- `asd_list_site_data`: File containing hub-site and ftm-site where *DMGR* should retrieve data.
- `start_dmgr`: Script file to run the *DMGR* in order to be prompted for run-time arguments.
- `keywords`: Directory with files defining areas and center related tiers.
- `airport_lookup_file`: File containing 51 airports in U.S. and Canada and the associated center and tier1 and tier2 center filenames to display when the specialist selects S or SETUP.
- `ALLCAN`: File containing names of all of the Canadian centers for ease in choosing all Canadian centers when issuing or releasing a groundstop.

- ALLUS: File containing names of all U.S. centers for ease in choosing all U.S. centers when issuing or releasing a groundstop.
- For every known Canadian center, such as CZE, there are three files that are displayed for ease in choosing all the centers listed in the files when issuing/releasing a groundstop.
 - CZE: File containing list of centers that directly border center CZE.
 - CZE1: File with tier 1 centers one center away from bordering CZE.
 - CZE2: File with tier 2 centers two centers away from bordering CZE.
- For every known U.S. center, such as ZAB, there are three files that are displayed for ease in choosing all the centers listed in the files when issuing/releasing a groundstop.
 - ZAB: File containing list of centers that directly border center ZAB.
 - ZAB1: File with tier 1 centers one center away from bordering ZAB.
 - ZAB2: File with tier 2 centers two centers away from bordering ZAB.
- FIFTEENWEST: Standard grouping of centers of fifteen U.S. Western centers.
- NOWEST: Standard grouping of centers for U.S. Eastern centers.
- SIXWEST: Standard grouping of centers of six U.S. Western centers.
- TENWEST: Standard grouping of centers of ten U.S. Western centers.
- TWELVEWEST: Standard grouping of centers of twelve U.S. Western centers.
- dmgr.config: Configuration file loaded by *DMGR* upon initialization.
- dmgr.help: Help file displayed when specialist hits HELP button.
- sfo__list.24192319.01: Tutorial file used in stand-alone run.
- /etms5/dmgr/fonts: directory containing various font files used by *DMGR*.

ETMS processes/databases provide three sorts of input to the *Delay Manager* in the form of:

- (1) Airport Arrival Capacity from TDB, requested at initialization or at specialist request for a change to a new airport.
- (2) LSTNET reports, obtained at initialization and updated every 5 minutes, thereafter.
- (3) Requests for a statistics report (S0 only) through net.mail

Other inputs are user inputs that the GUI interface elicits in order to show a modeled version of what the arrival load could be on an airport if a controller simulates issuing delays on incoming aircraft.

Output

Delay Manager is primarily a *Graphical User Interface* (GUI) display which outputs two different bar charts and reports to a user. The two bar charts are the *original* bar chart as if there were no delays issued and the *modeled* (simulated) bar chart. The modeled bar chart allows a specialist to visually determine whether his simulated delays had a positive effect (more even arrivals in each of the 15-minute interval arrival buckets) on arriving air traffic at the selected airport. Additionally, the specialist can click on a specific bar within the bar chart and see a report listing the flights comprising the demand for the 15-minute interval. The specialist can either choose M for the modeled report or O for the original bar chart. These reports can be sorted, according to specialist preference, by either the ETA (Estimated Time of Arrival) or by the departure center.

Other outputs are the two requests of ETMS for data and the statistic (s0 level) report output. The first request made is the TDB Airport Arrival Capacity. The second request is for LSTNET reports to be periodically returned to DMGR in order to update the specialist as to changing air traffic demands.

Also, if the *Delay Manager* is run in a pad (as opposed to via the TMGR process), some traceback information is available.

Processing Overview

The *Delay Manager* can be broken into two distinct subsystems.

- *DMGR ETMS Communications* subsystem
- *GUI* subsystem

The first subsystem is the *DMGR ETMS Communications* subsystem, which hooks up to Network Addressing, interfaces with external ETMS databases and reads in

database information. The *DMGR ETMS Communications* subsystem can be thought of as the back-end of the program.

The second subsystem is the *Graphical User Interface (GUI)* subsystem, which copies the data from the first subsystem into its own arrays and variables and displays the data in bar chart form and in report form. This can be viewed as the front-end of the *Delay Manager* program.

The *GUI* subsystem calls the first routine *GSUI_PowerUP* to start up the *DMGR* process; then control is passed to the *DMGR ETMS Communications* subsystem, in order to read in program arguments, parameters, and data files. Then the *DMGR ETMS Communications* subsystem connects to Network Addressing and makes a request of the TDB as to the desired airport's arrival capacity. Initially, and every five minutes thereafter, the *DMGR ETMS Communications* subsystem makes a LSTNET request in the background in order to retrieve flight information, fill it into arrays and variables, and notify the *GUI* that updated arrays/variables are available for the *GUI* to copy the flight information into its own copy of arrays and variables.

Delay Manager can receive errors from the ETMS processes it communicates with and relay such errors back to the specialist. Before it attempts communications with outside processes, the *Delay Manager* relays to the specialist that such communication will be attempted. If it has trouble connecting to an outside ETMS process, error messages are relayed to the specialist. In Table 14-1, the left side denotes messages about imminent connection/request activity and successful connection/request messages. The right hand side denotes the error messages that occur if the request for connection or data should fail.

The last message is as follows: *Requesting Data for [airport name]*. Shortly afterwards, a color coded bar chart appears or is updated in the top half of the display.

Table 14-1. Delay Manager Error Messages

List Of Request Messages To Specialist And Positive Responses	If Delay Manager Fails To Connect Or Receive Response, Delay Manager Sends The Ensuing Error Message
Attempting to connect to Node switch	
Connected to Node Switch	Failed to connect to Node switch
Got ListServer Address <Site-Name>	Failed to get ListServer Address <SiteName>
Got TDB Address <Site-Name>	Failed to get TDB Address <Site-Name>
Connected to Site: <Site-Name>	Failed to connect to Site: <Site-Name>
Requesting Data For BOS	Will try again in 5 minutes

14.1 DMGR ETMS Communications Subsystem

Purpose

The purpose of this subsystem is to perform all the back-end processing required to connect to ETMS Network Addressing, request data from ETMS processes, process statistics requests, and read returned data and error messages from ETMS processes in order to allow the *GUI* subsystem to focus on displaying flight data and responding to user *GUI* inputs in a timely manner.

Input

The input to the *DMGR ETMS Communications* subsystem is as follows:

- Statistics requests, level 0, that came from the ETMS process, net.mail.
- TDB message indicating a requested airport's arrival capacity

- A LSTNET report, which is read into arrays, flight by flight, providing key fields are in a flight record. Key fields are fields that are essential to the *DMGR* process for modeling. If a flight is missing an essential field, the flight is not included in the flight list passed to the *GUI* for display in either the original or modeled bar charts and reports. Fields that are considered key are listed below. An example of a LSTNET request and some sample output are provided to best see which fields are key and which are not.
- On 6/4 at about 18:05 the request below would be made:
REQ A BOS 6/4 1700 TO 100 LIST INFO ACID TYPE ORIG ETD DEST
ETA ETE DCENTR CGTD CGTA OGTD OGTA AC_CAT #END#
- Required field list (dash will force a skip to the next record):
 - ACID: Aircraft or Flight Id
 - ETA: Estimated Time of Arrival
 - OGTD: Original Gate Time of Departure
 - OGTA: Original Gate Time of Arrival
- Connection messages from Network Addressing confirming connection to node.sw, TDB is or is not up and running, LSTNET is or is not up and running, etc.
- Input from the *GUI* subsystem as to any modeling/simulation that the specialist has specified in order to apply the *DMGR ETMS Communications* primitive simulation algorithm on flight data after it has been read in from LSTNET.

Output

The output from the *DMGR ETMS Communications* subsystem is as follows:

- Request for connection to node.sw.
- Statistics (S0 level) response message to net.mail
- A variety of original arrays and variables filled for the *GUI* to quickly load the *DMGR ETMS Communications* arrays and variables into its own copy of original arrays and variables.
- A variety of simulated arrays and variables filled for the *GUI* to quickly load the *DMGR ETMS Communications* arrays and variables into its own copy of simulated/modeled arrays and variables.
- Messages to the *GUI* to display, such as *Requesting Data* messages, warnings and errors from node.sw, TDB, and LSTNET.

- A variety of trace lines output to the *DMGR* pad.

Processing

The *DMGR ETMS Communications* subsystem is responsible for all external ETMS communications. It sets event timers to determine when to get new updates from LSTNET in order to keep updating the *GUI* with fresh flight data every five minutes. Once it loads in all the data from LSTNET, it then applies a primitive simulation algorithm on any modeling the specialist has done via the *GUI* in order to provide another set of simulated (as well as original) arrays and variables to the *GUI*. *DMGR ETMS Communications* program modules, routines and variable names can usually be distinguished from *GUI* subsystem modules, routines and variables by name. The *DMGR ETMS Communications* uses the prefix *GS_* whereas the *GUI* subsystem uses the prefix *GSUI_*.

14.2 GUI Subsystem

Purpose

The *GUI* subsystem produces an *original* bar chart, and, if the specialist has done any modeling, a *modeled* bar chart. Each of these bar charts is accompanied by reports of flights that comprise each bar or the entire display.

Execution Control

The *GUI* can be summoned by a mouse click or keystroke. The top half of the window displays the bar chart. If a specialist clicks on *Setup* or types *S*, the bottom half of the display is brought up to elicit responses to the type of ground delay and time range desired, effecting certain centers or a tier of centers associated with the airport the specialist is working with or all Canadian or all U.S. Centers. Tiers of centers is a phrase used to describe the centers adjacent to the center containing the airport being examined by the *DMGR* program. Tier 1 centers are those that directly border the center containing the airport. Tier 2 centers are those centers that are two centers away from bordering the center containing the airport.

Input

- Arrays and variables filled with flight data from the *DMGR ETMS Communications* subsystem that make up the bar charts and the reports.
- User keypad inputs to the *GUI* such as *hot-keys*, clicking mouse on radio buttons, clicking mouse on square buttons (for multiple choice), and keypad inputs.

- User Setup inputs to simulate a ground delay.
- User Adapt inputs to change airport, string giving *DMGR* data, time range displayed by the bar chart, etc.

Output

The *GUI* subsystem output is the *Graphical User Interface* containing the *original*, and, if the specialist has done any modeling, the *modeled* bar chart. Each of these bar chart is accompanied by reports of flights that comprise each bar or the entire display. The top half of the window is the bar chart. The bottom half of the display shows the type of ground delay and time range desired:

- The upper half of the display, which displays original bar chart, or modeled bar chart, can display flight lists associated with the displayed bar chart. This can show a specialist the effect of not only implementing a ground stop but once a ground stop is in effect, it can also be used to see the effects of releasing a ground stop. The specialist can simulate a more controlled lifting of the stop by indicating what centers will be released.

DMGR does not automatically know what the current ground stop program is; it uses the one that the specialist had previously set up using the ground stop simulation. Figure 14-2 shows an example of an original bar chart as displayed by the *GUI*. Figure 14-3 shows an example of a modeled bar chart as displayed by the *GUI*.

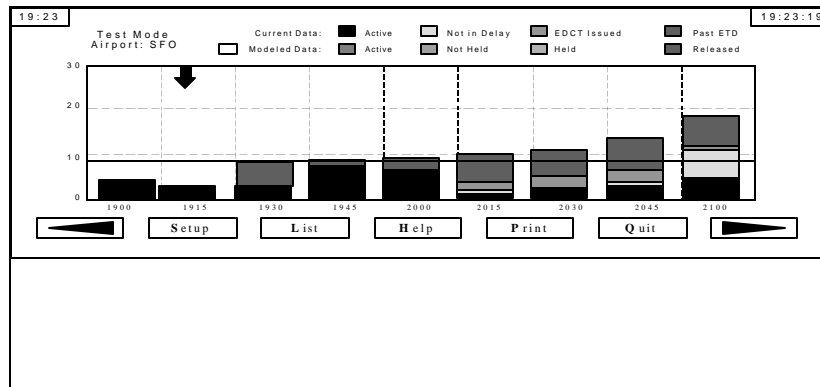


Figure 14-2. GUI Original Bar Chart

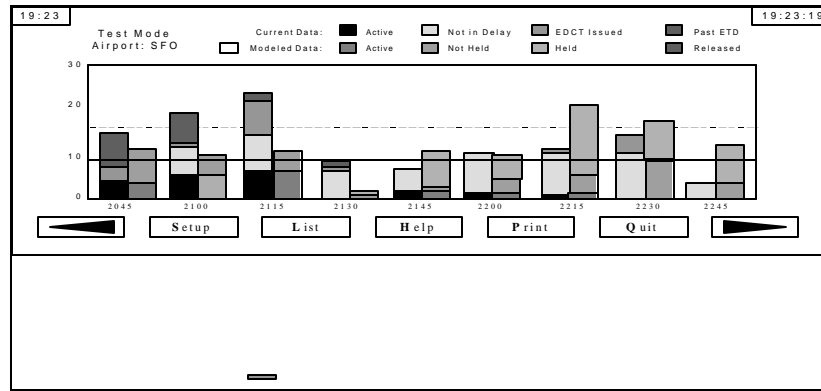


Figure 14-3. GUI Modeled Bar Chart

- A setup display (the lower half of the display) that allows the specialist to enter and remove simulated ground stops and view the effect on airport arrival traffic is shown in Figure 14-4. This shows a display for an airport, such as SFO, in ZOA airspace. The airport_lookup_table determines which three centers are displayed in order to choose a tiered center approach instead of clicking on the desired centers manually.

Start <input type="text" value="0000"/>		Stop <input type="text" value="0000"/>		<input type="checkbox"/> ZOA <input type="checkbox"/> ZOA1 <input type="checkbox"/> ZOA2 <input type="checkbox"/> All <input checked="" type="checkbox"/> None	
<input type="checkbox"/> ZAN	<input type="checkbox"/> ZLA	<input type="checkbox"/> ZKC	<input type="checkbox"/> ZNY	<input type="checkbox"/> ZMA	<input type="checkbox"/> CZY
<input type="checkbox"/> ZSE	<input type="checkbox"/> ZAB	<input type="checkbox"/> ZME	<input type="checkbox"/> ZOB	<input type="checkbox"/> ZSU	<input type="checkbox"/> CZU
<input type="checkbox"/> ZLC	<input type="checkbox"/> ZMP	<input type="checkbox"/> ZFW	<input type="checkbox"/> ZDC	<input type="checkbox"/> CZV	<input type="checkbox"/> CZQ
<input type="checkbox"/> ZDV	<input type="checkbox"/> ZAU	<input type="checkbox"/> ZHU	<input type="checkbox"/> ZTL	<input type="checkbox"/> CZE	<input type="checkbox"/> CZM
<input type="checkbox"/> ZOA	<input type="checkbox"/> ZID	<input type="checkbox"/> ZBW	<input type="checkbox"/> ZJX	<input type="checkbox"/> CZW	<input type="checkbox"/> ZLN
<input type="checkbox"/> Keyword: <input type="text"/>					
EDCT	GS	At	To	Release	Min-In-Tail
<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	05
<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	05
<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	05
<input checked="" type="checkbox"/> Jet <input checked="" type="checkbox"/> Turbo <input checked="" type="checkbox"/> Prop					
<input type="button" value="Adapt"/> <input type="button" value="Model"/> <input type="button" value="Send EDCT"/> <input type="button" value="SDCT"/> <input type="button" value="Close"/>					

Figure 14-4. GUI Setup Display

- An adapt menu (which overlays the bar chart) allows the specialist to change the site sending data, the airport being displayed, the time range being displayed, etc.
- Display of an online help file.
- Printed output which can be elicited by the specialist clicking on a radio button for PRINT.
- The *GUI* outputs information about what groundstops the specialist has created in order for the *DMGR ETMS Communications* subsystem to apply a simulation algorithm on new data from LSTNET based on the ground stops the specialist has applied.

Processing

The *GUI* subsystem is an HP/Apollo GPR event-driven system where various hot keys, incoming updates, timers, keyboard inputs, etc., can trigger display changes. The *GUI* subsystem loads in an original and a modeled set of arrays and variables in order to toggle the user bar chart display between what the specialist received originally and what they have simulated. The specialist can then create more ground stops or releases ground stops using the keyboard and/or mouse keys to continue to improve what has been simulated. The *GUI* software modules, routines, and variable names can usually be distinguished from *DMGR ETMS Communications* modules, routines, and variables by name. The *GUI* subsystem routines, modules, and variable names usually begin with GSUI_ (not GS_).